

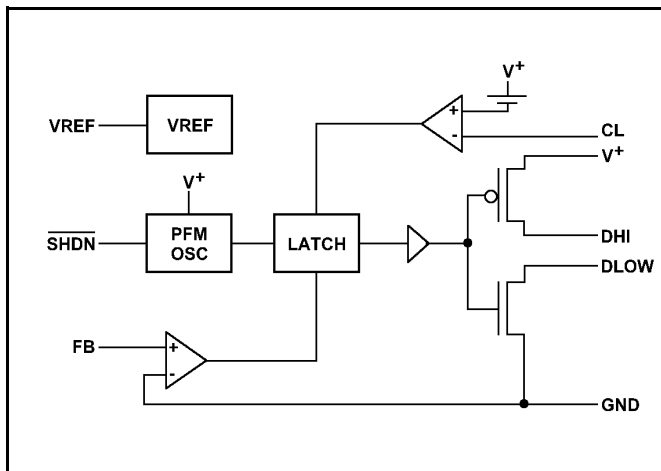
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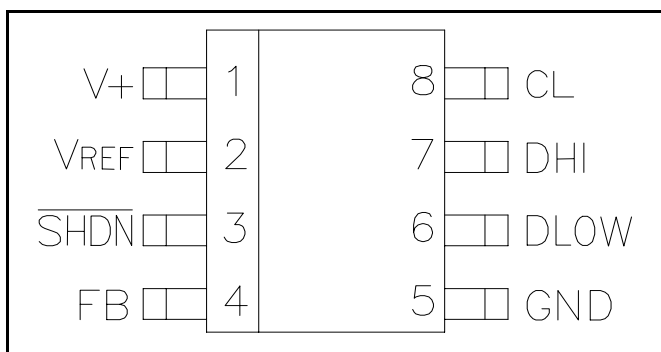
DESCRIPTION

The SC1652 is a high performance inverting DC-DC converter, designed to drive an external power switch to generate programmable negative voltages. In the particularly suitable LCD bias contrast application, efficiency of 87% can be achieved with low cost PNP bipolar transistor drivers. The output voltage can be scaled to -40V by two external resistors. A pulse frequency modulation scheme is employed to maintain high efficiency conversion under wide input voltage ranges. Quiescent current is about 80 μ A and can be reduced to 0.7 μ A in shutdown mode. With a switching frequency range of 70kHz to 160kHz, small size switching components may be used, which is ideal for battery powered portable equipment such as notebook and palmtop computers.

BLOCK DIAGRAM



PIN CONFIGURATION



FEATURES

- 2.4V to 7V input voltage operation
- Adjustable output voltage up to -40V
- Low quiescent current at 80 μ A
- Pulse frequency modulation maintains high efficiency (max 87%)
- 70kHz to 160kHz switching frequency
- Power-saving shutdown mode (0.7 μ A typical)
- High efficiency with low cost external PNP bipolar transistor

APPLICATIONS

- Negative LCD Contrast Bias for
 1. Notebook & palmtop computers
 2. Pen-based data systems
 3. Portable data collection terminals
 4. Personal digital assistants
- Negative voltage supplies

ORDERING INFORMATION

DEVICE ⁽¹⁾	V _{OUT}	PACKAGE
SC1652CS	Adj	SO-8

Note:

(1) Add suffix 'TR' for tape and reel.

ABSOLUTE MAXIMUM RATINGS

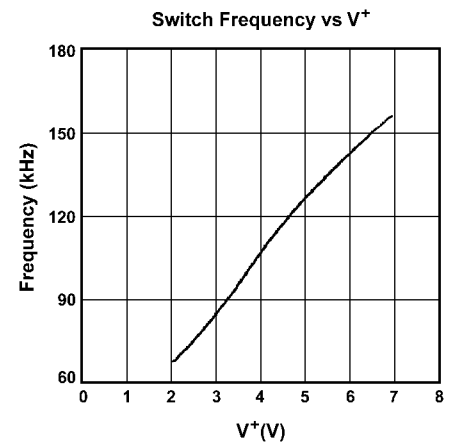
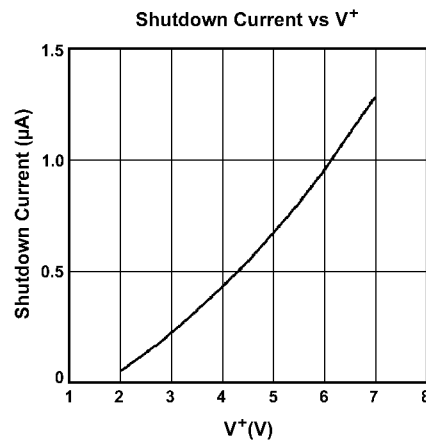
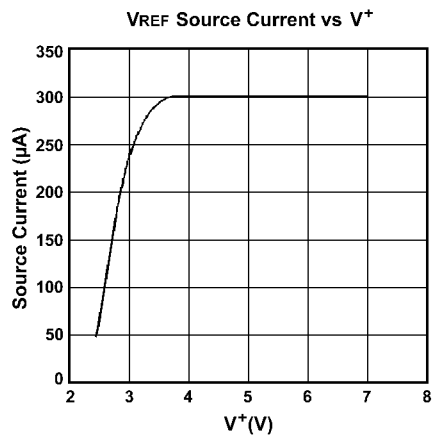
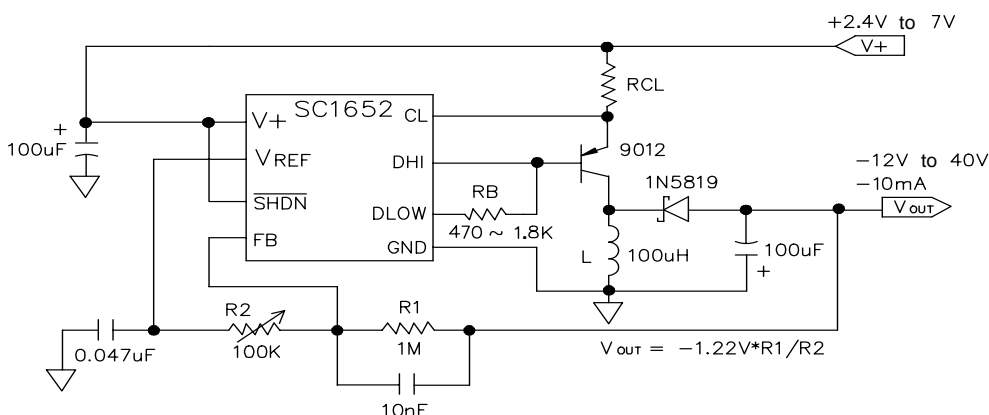
Parameter	Symbol	Maximum	Units
Supply Voltage	V ⁺	7.0	V
Operating Temperature Range	T _A	0 to 70	°C
Storage Temperature Range	T _{STG}	-65 to 125	°C

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ELECTRICAL CHARACTERISTICS

 Unless otherwise specified, $T_A = 25^\circ\text{C}$, $V^+ = 5\text{V}$

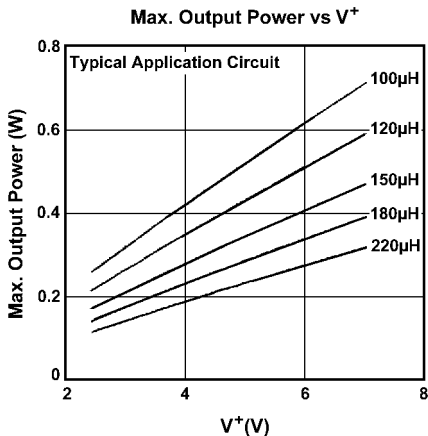
Parameter	Test Conditions	Test Limits			Units
		Min	Typ	Max	
Input Voltage		2.4		7	V
Switch Off Current			80	150	μA
Shutdown Mode Current			0.7	2	μA
V_{REF} Voltage	$I_{\text{SOURCE}}=250\mu\text{A}$	1.16	1.22	1.28	V
V_{REF} Source Current		250			μA
DLOW "ON Resistance"			5		Ω
DHI "ON Resistance"			7		Ω
CL Threshold		45	60	75	mV
Shutdown Threshold		0.8	1.5	2.4	V

TYPICAL PERFORMANCE CHARACTERISTICS

TYPICAL APPLICATION CIRCUIT


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TYPICAL APPLICATION INFORMATION

The typical application circuit generates an adjustable negative voltage for contrast bias of LCD displays. Efficiency and output power can be optimized by using the appropriate inductor and switch. The following formulas provide a guideline for determining the optimal component values:



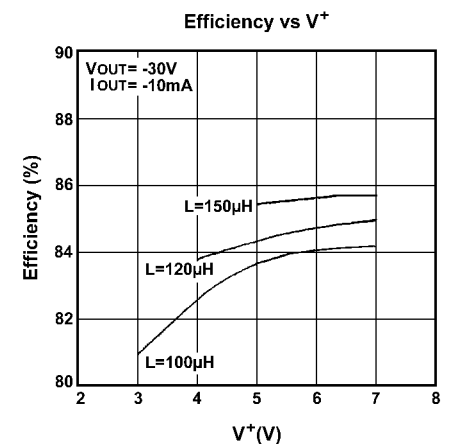
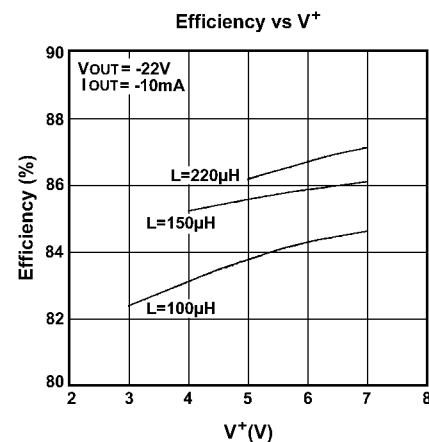
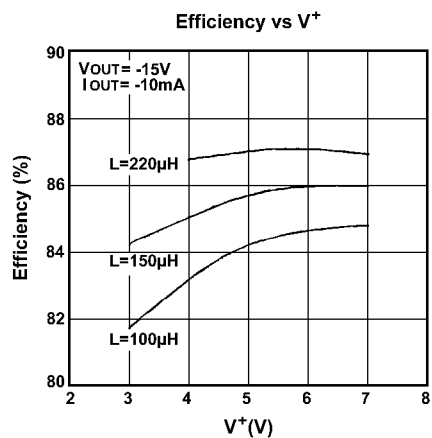
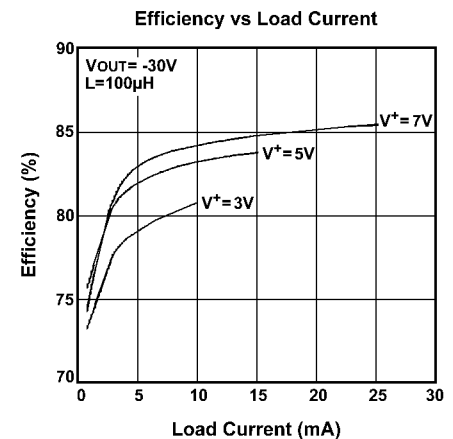
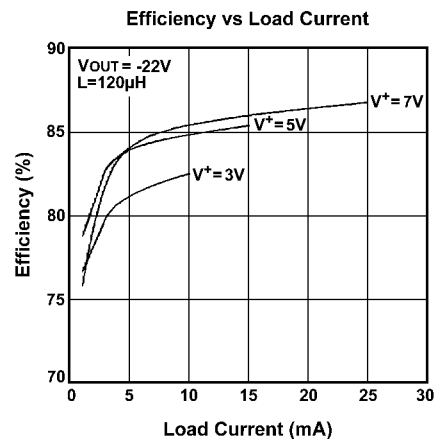
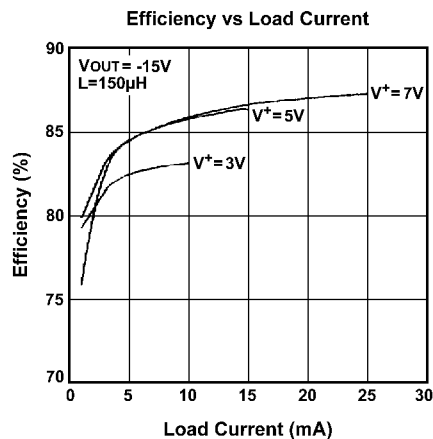
$$L = (11.1 - 0.15 \times V^+) \times \frac{V^+}{|I_{OUT}| \times |V_{OUT}|}$$

$$\text{PNP: } |V_{CE0}| > V^+ + |V_{OUT}|$$

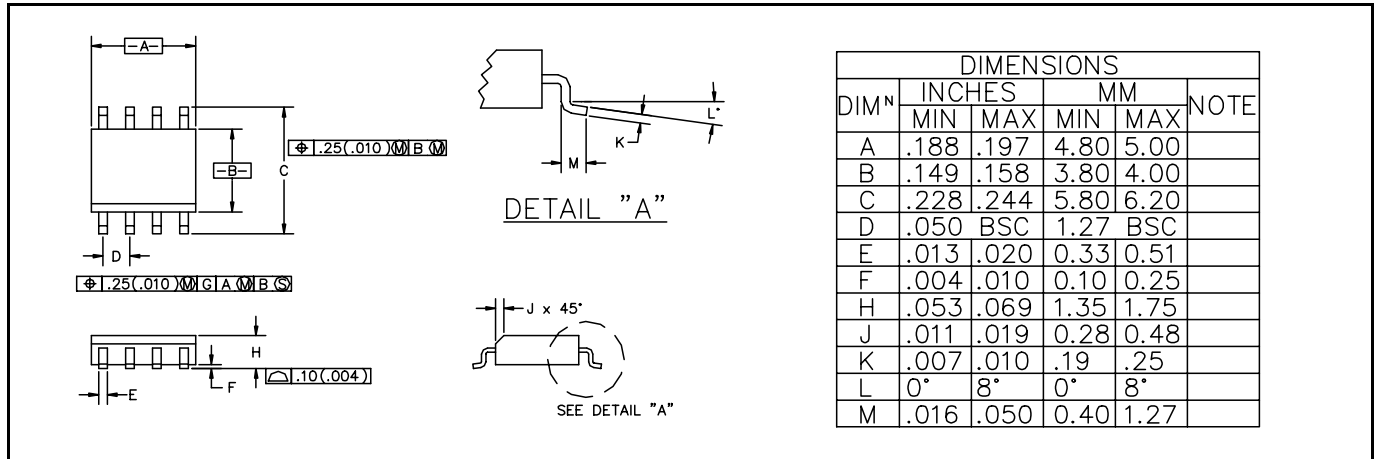
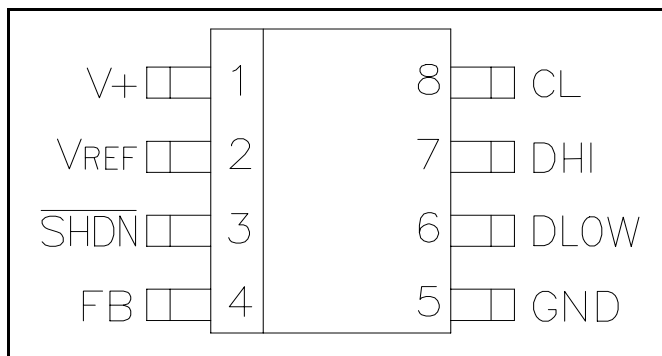
$$|I_{C(\text{MAX})}| \geq 200 \times \frac{|I_{OUT}|}{V^+}$$

$$|V_{CE(\text{SAT})}| < 0.4\text{V at } I_C = 200 \times \frac{I_{OUT}}{V^+} \text{ and } \beta = 10$$

$$R_B \cong 3 \times L \times (V^+ - 0.8), \text{ where units: } V^+ \text{ in Volt, } V_{OUT} \text{ in Volt, } I_{OUT} \text{ in Ampere, } L \text{ in } \mu\text{H, } R_B \text{ in Ohm.}$$



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OUTLINE DRAWING SO-8

PIN CONFIGURATION

PIN DESCRIPTIONS

PIN 1: V⁺ 2.4V to 7V input supply voltage.

PIN 2: V_{REF} 1.22V reference output. Bypass with a 0.047μF capacitor to GND. Sourcing capability is guaranteed to be greater than 250μA.

PIN 3: SHDN Logic input to shutdown the chip.
 >1.5V = normal operation,
 GND = shutdown.
 In shutdown mode DLOW and DHI pins are high.

PIN 4: FB Feedback signal input to comparator. Connecting a resistance R₁ to V_{OUT} and a resistance R₂ to V_{REF} yields the output voltage:

$$V_{OUT} = -\frac{R_1}{R_2} \times V_{REF}$$

PIN 5: GND Power ground.

PIN 6: DLOW Driver sinking output. Connected to DHI when using an external P-channel MOSFET. When using an external PNP bipolar transistor, connect a resistor R_B from this pin to DHI. R_B value depends upon V⁺, inductor value and the PNP bipolar transistor. By adjusting the R_B value, efficiency can be optimized.

PIN 7: DHI Driver sourcing output. Connect to the gate of the external P-channel MOSFET or base of the PNP bipolar transistor.

PIN 8: CL Current-limit input. This pin clamps the switch peak current under abnormal conditions.